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THE DUETTING BEHAVIOR OF EASTERN SCREECH-OWLS

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ABSTRACT.—We examined duetting behavior of male and female Eastern Screech-Owls (*Otus asio*) and used removal experiments in an attempt to clarify function. Screech-owls uttered an average of 6.4 bounce songs during duetting bouts, and the songs of participating males and females sometimes overlapped. Male screech-owls initiated significantly more duets than did females. Five of six focal males and five of seven focal females engaged in duets, and significantly more duets occurred after replacement of temporarily-removed mates than prior to removal. The bounce songs given by screech-owls during duets exhibit significant individual and sexual variation and may be used to advertise the presence and identity of a mated pair, confirm the identity of a mate, or determine the sex of a prospective mate. *Received 17 Sept. 1992, accepted 16 Dec. 1992.*

In many species of birds, males and females utter overlapping bouts of vocalizations called duets. Although most duetting species are oscines, about one-third of known duetting species are nonpasserines (Farabaugh 1982). Duetting has been reported in the order Strigiformes (Johnsgard 1988, Voous 1988), and previous reports suggest that duetting owls may utter overlapping bouts of songs (e.g., Lundberg 1980, McGarigal and Fraser 1985) or overlapping bouts of songs and calls (e.g., Bondrup-Nielson 1984). However, little is known about the number and timing of songs or calls given by male and female owls during duets. Further, there is little experimental evidence concerning the function(s) of duetting, both among owls and other groups of birds. The Eastern Screech-Owl (*Otus asio*) has a repertoire of two song types (whinny song and bounce song), and one of these (bounce song) sometimes is used for duetting (Marshall 1967, Ritchison et al. 1988). The objectives of the present study were (1) to describe the duetting behavior of male and female Eastern Screech-Owls and (2) to use mate removal experiments in an attempt to determine the function(s) of duetting.

METHODS

This study was conducted at the Central Kentucky Wildlife Management Area, 17 km southeast of Richmond, Madison Co., Kentucky (see Belthoff 1987 for a description of the area). Screech-owls were captured beginning in October 1989 and fitted with a U.S.F.W.S. aluminum band plus a radio-transmitter. Once paired, male and female Eastern Screech-Owls typically roost near each other (Belthoff 1987, pers. obs.). Thus, nest boxes and natural cavities located near radio-tagged owls were checked regularly in an attempt to capture mates. Once both members of a presumed pair were radio-tagged, we continued to monitor

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their roost sites. If radio-tagged owls consistently roosted within 25 m or less of each other, we assumed they were paired. Nine presumed pairs of screech-owls were observed during the study. Paired status was confirmed for four pairs by observations made during the breeding season. Confirmation of status was not possible for five pairs because of the death of one member of the presumed pair prior to the breeding season. The sex of each member of a pair was determined by analyzing vocalizations (with those of females higher in frequency) and, if they survived, was confirmed by their behavior during the breeding season (Cavanagh and Ritchison 1987, Klatt 1992).

Mate removal experiments were conducted from January through mid-March in both 1990 and 1991. Experiments were conducted with six owls (both members of three pairs) in 1990 and with seven owls (both members of one pair plus one individual from each of 5 additional pairs) in 1991. When both members of a pair were studied, the experiment with the second owl began the night after completion of the experiment with the first owl. All experiments consisted of three periods: pre-removal, removal (capture and removal of mate), and replacement (release of mate). The removal and replacement of owls occurred during daylight hours and "replaced" owls were placed in a nest box or natural cavity located within 10 m of the focal owl's roost site. During each period, the focal owl was monitored for at least six hours over at least two nights. Nightly observations were three hours in duration and began either at sunset or when the focal owl first moved from its roost.

The location of focal owls and their mates was monitored using a receiver (Model TR-2, Telonics, Inc., Mesa, Arizona) with a two-element yagi antenna (Telonics, Inc.). Observations of focal owls were generally made from a distance of about 40 to 75 m, i.e., sufficiently distant to minimize disturbance but close enough to record vocalizations. Recordings were made using a Uher 4000 Report Monitor tape recorder with a Dan Gibson parabolic microphone. Vocalizations were analyzed using a Kay Elemetrics Corporation DSP Sona-Graph (Model 5500).

For each duetting bout, i.e., a series of bounce songs (see Cavanagh and Ritchison [1987] for a description of bounce songs) separated in time from each other by intervals of 60 sec or less, we noted the identity of the singer or singers (if possible) and the experimental period. Also noted were the number of bounce songs given by each individual and the intervals between songs. For each bounce song, we determined the number of notes, duration, tempo (notes per second), and frequency at maximum amplitude (FMA). FMA was determined on the sonagraph using a color-enhanced screen. If the bounce songs of duetting owls overlapped, we determined the extent of overlap. Chi-square tests were used to test for non-random distributions, while Wilcoxon tests were used for paired comparisons (SAS Institute 1985). Values are presented as means and standard errors.

RESULTS

Five of six focal males and five of seven focal females engaged in duets. Overall, no significant difference ($\chi^2 = 4.6$, df = 2, $P > 0.05$) was found among experimental periods in number of duetting bouts. However, among focal pairs, significantly more duets occurred during the replacement period than during the pre-removal period ($\chi^2 = 4.6$, df = 1, $P < 0.05$). Among focal individuals, two males engaged in duets with their mates during the pre-removal period, four owls (one male and three females) participated in duets with unknown owls (in the absence of their mates) during the removal period, and four owls (three males and one female) engaged in duets with their recently-released mates during the replacement period.

Individual Eastern Screech-Owls (N = 15) uttered an average of 6.4 ± 0.79 bounce songs during duetting bouts, with no significant difference (z = 1.24, P = 0.215) between males ($\bar{x}$ = 7.3 ± 1.2; N = 8) and females ($\bar{x}$ = 5.5 ± 1.1; N = 7). Screech-owls initiating duets gave an average of 4.05 ± 0.95 bounce songs before their duetting partner uttered a bounce song, with no significant difference (z = 0.77, P = 0.444) between males ($\bar{x}$ = 4.5 ± 1.2) and females ($\bar{x}$ = 2.8 ± 1.3). However, male screech-owls initiated significantly more (χ^2 = 4.54, df = 1, $P < 0.05$) duets (N = 16) than did females (N = 6).

During duets, the bounce songs of participating male and female screech-owls sometimes overlapped. Males (N = 8) gave 154 bounce songs during duets, and 17 (11.0%) either overlapped or were overlapped by the bounce songs of females. Females (N = 7) gave 120 bounce songs during duets, and 13 (10.8%) either overlapped or were overlapped by the bounce songs of males. The bounce songs given by female screech-owls during duets were significantly higher in frequency and slower in tempo (notes per second) than those given by males (Table 1). No other characteristics of bounce songs given by males and females during duets differed significantly (Table 1). In addition, male and female screech-owls did not differ significantly in the timing of their bounce songs during duets (i.e., the interval between the end of their partner's song and the beginning of their song) (Table 1).

Three male screech-owls gave bounce songs in both duetting and non-duetting contexts. Intersong intervals were significantly longer during duets for all three males (Table 2). In addition, bounce songs given during duets were generally longer (number of notes per song and song duration), faster in tempo, and lower in frequency (Table 2).

One female screech-owl gave bounce songs in both duetting and non-duetting contexts. Only the tempo of bounce songs varied significantly (z = 2.23, P = 0.0259), with notes given at a rate of 11.40 ± 0.82 per second (N = 21 songs) during duets and 14.75 ± 0.40 per second (N = 7 songs) in non-duetting contexts.

Discussion. — Paired male and female Eastern Screech-Owls in this study engaged in more duets during the replacement period than during the pre-removal period. In addition, several screech-owls duetted with unidentified conspecifics (perhaps prospective mates) during the removal period. Such results suggest that duetting by screech-owls plays a role in the establishment, or re-establishment, of pair bonds. Previous authors have suggested a similar function for duetting in Eastern Screech-Owls (Marshall 1967) as well as in other species of owls (Voous 1988).

Complex, pair-specific duets may strengthen pair bonds and prevent desertion because males and females must invest time and energy in learning such duets (Wickler 1980). In contrast, relatively simple, non-

TABLE 1

COMPARISON OF THE CHARACTERISTICS OF BOUNCE SONGS UTTERED BY MALE AND FEMALE EASTERN SCREECH-OWLS DURING DUETS[a]

Variable	Males[b]	Females[c]	Wilcoxon test	
			Z	*P*
Intersong interval (secs)	28.32 ± 2.30	25.40 ± 2.77	1.28	0.1995
Notes per song	60.10 ± 2.55	56.11 ± 2.98	1.04	0.2972
Song duration (secs)	3.81 ± 0.06	3.79 ± 0.20	0.37	0.7077
Notes per sec	15.64 ± 0.16	14.47 ± 0.28	3.77	0.0002
FMA[d] (Hertz)	589.11 ± 2.22	722.65 ± 6.11	13.88	0.0001
Number of notes overlapped[e]	4.32 ± 1.30	2.25 ± 0.71	0.14	0.8873
Interval since partner's last song (secs)	7.83 ± 1.31	13.16 ± 2.32	1.18	0.2385

[a] Values represent means ± standard errors.
[b] Based on 154 songs of eight males.
[c] Based on 120 songs of seven females.
[d] Frequency at maximum amplitude.
[e] Based only on overlapping songs.

TABLE 2

COMPARISON OF THE CHARACTERISTICS OF BOUNCE SONGS UTTERED BY THREE MALE EASTERN SCREECH-OWLS IN DUETTING AND NON-DUETTING CONTEXTS[a]

Variable	Male 1[b]		Male 2[c]		Male 3[d]	
	Duetting	Non-duetting	Duetting	Non-duetting	Duetting	Non-duetting
Intersong interval (secs)	43.03 ± 5.28	34.28 ± 1.75*	19.41 ± 1.76	16.74 ± 1.44*	32.59 ± 5.90	20.10 ± 1.58*
Notes per song	83.27 ± 5.96	70.04 ± 1.43*	66.36 ± 4.99	58.99 ± 2.55*	43.39 ± 3.52	41.02 ± 1.12
Song duration (secs)	4.83 ± 0.32	4.17 ± 0.08*	4.08 ± 0.40	3.74 ± 0.14	2.94 ± 0.19	2.82 ± 0.06
Notes per sec	16.96 ± 0.22	16.59 ± 0.08*	16.61 ± 0.27	15.43 ± 0.13*	14.53 ± 0.23	14.44 ± 0.08
FMA[e] (hertz)	596.9 ± 2.2	598.9 ± 0.5	588.9 ± 1.6	592.9 ± 1.1	632.2 ± 2.8	655.5 ± 1.2*

[a] Values represent means ± standard error. An asterisk indicates a significant difference (Wilcoxon test, $P < 0.05$) between songs given in duetting versus non-duetting contexts.
[b] N = 26 songs in duetting context and N = 267 songs in non-duetting context.
[c] N = 53 songs in duetting context and N = 168 songs in non-duetting context.
[d] N = 23 songs in duetting context and N = 126 songs in non-duetting context.
[e] Frequency at maximum amplitude.

specific duets, like those of Eastern Screech-Owls, are more likely used to advertise the presence of a mated pair (Wickler 1980) or to advertise identity (Martin 1974). The bounce songs uttered by screech-owls during duets exhibit significant individual and sexual variation (Cavanagh and Ritchison 1987, Klatt 1992) and, thus, could be used to advertise the presence and identity of a mated pair, confirm the identity of a mate, or determine the sex of a prospective mate.

We found that bounce songs given by male screech-owls during duets were typically longer than those uttered in non-duetting contexts. Previous studies have revealed that bounce songs are used in both aggressive and non-aggressive contexts (Ritchison et al. 1988). Cavanagh and Ritchison (1987) reported that bounce songs given in response to playback (and, therefore, presumably serving an aggressive function) had a mean duration of 2.3 sec and consisted of an average of 32.3 notes. In contrast, bounce songs given by screech-owls during duets in our study had a mean duration of 3.8 sec and consisted of an average of 58.4 notes. Such differences indicate that the message being conveyed by a screech-owl uttering bounce songs depends in part on song length, with songs of increasing duration conveying decreasing levels of aggression.

Although our study focused on intrapair communication, the duets of male and female Eastern Screech-Owls also play a role in territory defense (Smith et al. 1987, Ritchison et al. 1988). Paired Eastern Screech-Owls defend territories throughout the year (Belthoff et al. 1993), and, in such species, pair defense is probably the best defense against expansion by neighboring territorial pairs (Farabaugh 1982).

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